

Vertebrate fauna survey of White Mountains National Park in the Desert Uplands Bioregion, central-north Queensland

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ABSTRACT

The patterns of composition and distribution of vertebrate fauna in Queensland's tropical savannas are poorly known. The sandstone landscapes of White Mountains National Park are considered to be significant for fauna given its geographical position on the Great Dividing Range. A survey at White Mountains National Park was undertaken in order to determine the species present, and place them in the context of the assemblages recorded within the Desert Uplands Bioregion. Standardised trapping and incidental data collection techniques were used and a total of 122 vertebrate fauna species (53 being new to the park) were identified. The fauna assemblage contains a mix of vertebrates with some affiliation to north-eastern Queensland tropical savannas (e.g. *Anomalopus gowi*, *Uperoleia lithomoda*, *Chaerephon jobensis*), more mesic east coastal environments (e.g. *Glaphyromorphus punctulatus*, *Planigale maculata*, *Rattus sordidus*) and species distributed generally within and west of the Desert Uplands (e.g. *Pseudomys desertor*, *Ctenotus rosarium*, *Gehyra variegata*, *Lerista wilkinsi*).

Key words: White Mountains National Park, Desert Uplands, Queensland, fauna survey.

Introduction

The distribution and composition of the vertebrate fauna of the tropical savannas of northern Queensland are surprisingly poorly known and surveyed. Bioregional or systematic smaller-scale surveys have rarely been undertaken. This has in part to do with both the tyranny of distance and the perception that the biological significance of semi-arid areas is only of moderate interest compared to the diversity of the wet tropical and sub-tropical coast (Kirkpatrick and Lavery 1979). For example, the Wet Tropics bioregion has been intensively studied (see references and data sources in Williams *et al.* 1996), but large-scale surveys in wet-dry tropics have only ever been undertaken sporadically in the past (Lavery 1968; Lavery and Johnson 1968; Lavery and Johnson 1974; Lavery and Seton 1974; Winter and Atherton 1985; Blackman *et al.* 1987; Hannah and Thurgate 2001).

Faunal information also exists for many of Queensland's National Parks but these are, with very few exceptions, either indicative species lists or observational species lists with no associated location, habitat or abundance information. This is the case for White Mountains National Park. Historically, the White Mountains and Torrens Creek region was

traversed and surveyed for "rarer native fauna" in the 1920s by the British Museum (Wilkins 1929), though exact details of species seen or collected are lacking. However the holotype for the skink *Lerista wilkinsi* was collected from the region and named after the expedition leader Sir George Hubert Wilkins (Parker 1926).

This paper reports the results of a vertebrate fauna survey at White Mountains National Park, conducted as part of a joint Scientific Expedition to the region organised by the Royal Geographic Society of Queensland and Australian Geographic. The major rationale for the focus of the survey in this area is the perceived biological significance of the landscapes. The White Mountains is one of a series of sandstone outcrops that occur along the edge of the Great Artesian Basin in Queensland. These formations, in particular the deep-sheltered gorges, springs and associated habitats are considered to provide significant refugia for biological diversity (AHC 2001). The primary aim was to record the vertebrate species presence and abundance at White Mountains, and the patterns of fauna assemblage in the context of the wider Desert Uplands Bioregion in which the park is located.

Methods

Study area

White Mountains National Park (location 23° 30'S, 145° E, and hereafter called White Mountains) lies within the Desert Uplands Bioregion in north-central Queensland, which itself is situated within Australia's northern tropical savannas (Fig. 1). The bioregion sits astride the Great Dividing Range between Charters Towers, Hughenden and Blackall and shares boundaries with the Northern Brigalow Belt to the east and south, the Einasleigh Uplands to the north and the Mitchell Grass Downs to the west. The bioregion is semi-arid and the major vegetation associations consist of open *Acacia* and *Eucalyptus* woodlands, ephemeral lake and dune systems and hummock and tussock grasslands. Sandstone ranges and sand plains dominate the region and the soils are of poor structure and fertility (Sattler and Williams 1999).

The White Mountains covers an area of approximately 108,000 ha. It is situated 80 km north-east of Hughenden and 140 km south-west of Charters Towers within the northern-most extremity of the Alice Tableland Sub-region of the Desert Uplands (Fig. 1.). The park encompasses the highest elevation areas (450-780 m) of the bioregion (typically less than 400 m). The landforms and geology consist of colluvial and fluvial sediments overlying Triassic sandstones, revealed by deep weathering, resulting in plains

and plateaux, and elevated rugged ranges and hills, which are often deeply dissected. The White Mountains straddles the boundary of three major river catchments, (Flinders River flowing to the Gulf, Burdekin River flowing to the east coast and Torrens Creek feeding into the Lake Eyre Basin) further emphasising its biogeographic significance.

Sampling

The vertebrate fauna survey was conducted over a 10-day period from 9-18 April 2000. Sampling was undertaken in two general survey areas within the White Mountains based around Warang Homestead and Rugged Gorge (Fig. 1). Three general approaches to the sampling were used: standardised quadrat sampling, incidental sampling and active searches. The standardised quadrat sample utilised a nested trap and search array, modified from Woinarski and Fisher (1995), incorporating four pitfalls arranged in a 'T' configuration (30 and 20 m of drift fence), 20 small Elliott traps and two cages. The base quadrat area was a 50 x 50 m square demarcated by the Elliott traps placed 10 m apart along the perimeter, with the pitfalls placed along one edge of this array. Trapping was supplemented by timed searches: four instantaneous morning bird counts within a 1 ha area, and two diurnal and two nocturnal searches each of 30 minute duration conducted within the 50 m square. All Elliott and cage traps were baited with peanut butter, honey and rolled oats, alternating with pet biscuits. All traps were checked in the morning and afternoon.

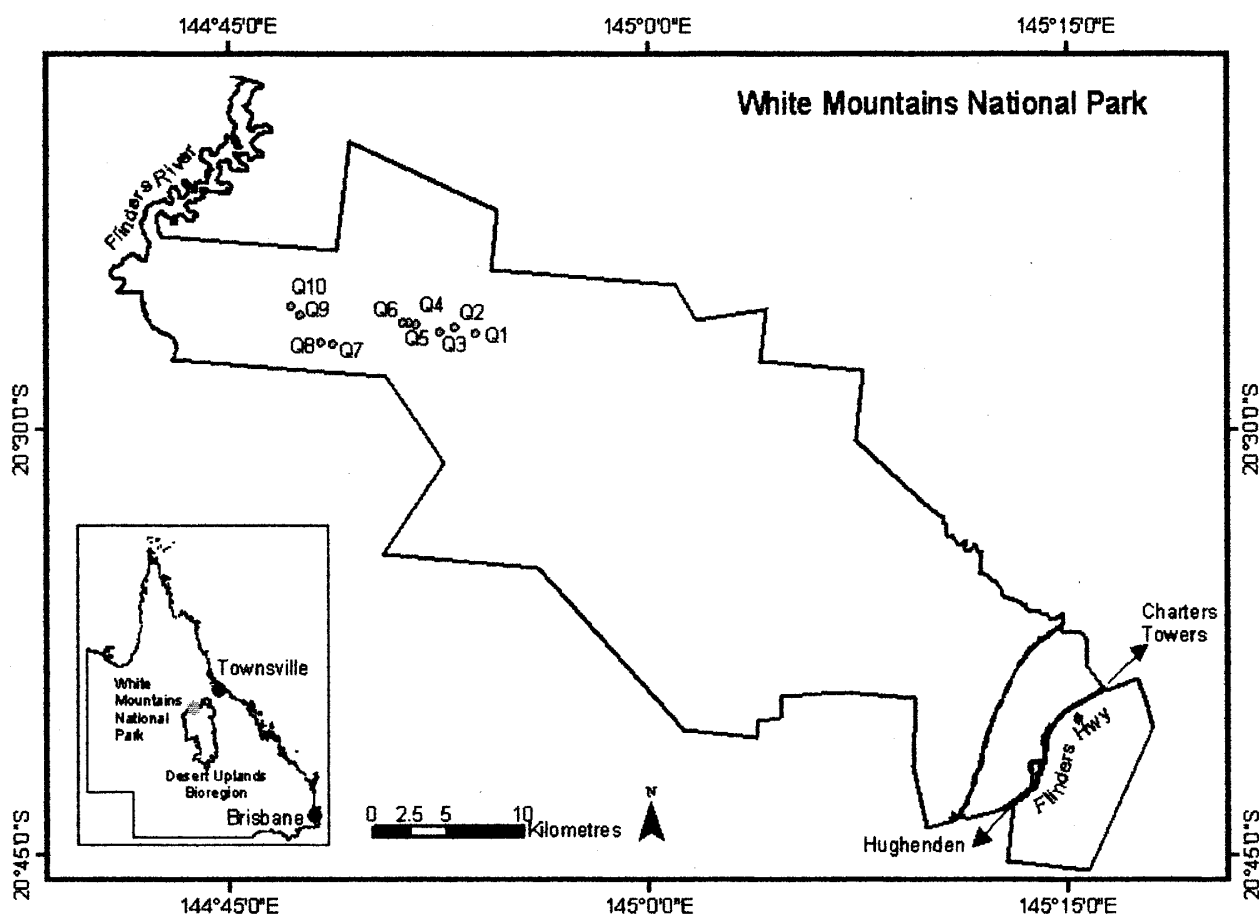


Figure 1 Location of sampling quadrats within White Mountain National Park and the indicative location of the park in Queensland.

At Warang, 10 quadrats were sampled over the 10-day period. In addition, targeted active searching and incidental trapping (harp trapping at four locations and

ultrasonic bat detection [Anabat 6, Titley Electronics, Ballina] at eight locations) was conducted (Table 1). At Rugged Gorge only incidental trapping (harp trapping at

Table 1. Location of the trapping quadrats, harp traps and bat detectors including regional ecosystem (RE) type and description. Latitude and longitude presented in decimal degrees.

Site	RE	Latitude	Longitude	Vegetation description
Q1	10.4	20.44432	144.89735	Low heath of <i>Grevillea decora</i> , <i>Acacia leptostachya</i> and <i>Persoonia falcata</i> with a ground cover of <i>Leptosema chapmanii</i> and <i>Triodia longiceps</i> . Occasional emergent <i>Corymbia lamprophylla</i> and <i>Lysicarpus angustifolia</i> .
Q2	5.9	20.44078	144.88552	Woodland of <i>Corymbia leichhardtii</i> , <i>Eucalyptus quadricostata</i> and <i>Corymbia brachycarpa</i> to 16 m, with a dense shrubby understorey of <i>Acacia</i> spp., <i>Grevillea</i> spp. and <i>Petalostigma banksii</i> . <i>Triodia bitextura</i> dominates groundcover on stony soils.
Q3	5.9	20.44307	144.87649	Tall woodland of <i>Eucalyptus quadricostata</i> , <i>Corymbia brachycarpa</i> and <i>C. leichhardtii</i> to 20m, over a moderate shrub layer of <i>Petalostigma pubescens</i> , <i>Acacia longispicata</i> and <i>Persoonia falcata</i> . Dense grassy ground cover predominantly of <i>Themeda avenacea</i> , <i>Chrysopogon fallax</i> , <i>Triodia bitextura</i> , <i>Aristida</i> spp.
Q4	5.9	20.43904	144.86211	Woodland of <i>Eucalyptus quadricostata</i> , <i>Corymbia brachycarpa</i> , over a moderate shrub layer of <i>Petalostigma pubescens</i> , <i>Bursaria incana</i> , <i>Acacia longispicata</i> . Dense ground cover predominantly of <i>Themeda triandra</i> , <i>Chrysopogon fallax</i> , <i>Triodia bitextura</i> , <i>Sorghum plumosum</i> .
Q5	5.9	20.43783	144.85773	Open woodland of <i>Eucalyptus quadricostata</i> , <i>Corymbia brachycarpa</i> , over an open shrub layer of <i>Petalostigma banksii</i> , <i>Melaleuca nervosa</i> , <i>Jacksonia ramosissima</i> . Low ground cover on shallow stony soils predominantly of <i>Triodia bitextura</i> , and occasional tussock grasses.
Q6	5.9	20.43817	144.85439	Tall woodland of <i>Eucalyptus quadricostata</i> , <i>Corymbia brachycarpa</i> to 20 m, over an open shrub layer to 3 m of <i>Petalostigma pubescens</i> , <i>Bursaria incana</i> , and <i>Acacia longispicata</i> . Dense grassy ground cover predominantly of <i>Themeda triandra</i> , <i>Chrysopogon fallax</i> , <i>Heteropogon contortus</i> and <i>Sorghum plumosum</i> .
Q7	10.4	20.45047	144.81285	Low <i>Lysicarpus angustifolius</i> woodland to 8 m with dense shrubby understorey of <i>Acacia</i> spp. <i>Grevillea decora</i> , <i>Dodonaea filifolia</i> , <i>Jacksonia ramosissima</i> . Groundcover of <i>Triodia bitextura</i> on shallow stony soils.
Q8	10.4	20.44942	144.80571	Open <i>Eucalyptus exilipes</i> woodland to 14 m with a sparse shrub layer of <i>Petalostigma pubescens</i> and <i>Comesperma pallidum</i> to 2 m and a dense groundcover of <i>Triodia bitextura</i> on shallow stony soils.
Q9	7.7	20.43379	144.79278	Low <i>Melaleuca tamariscina</i> heath over a shrub layer of <i>Jacksonia ramosissima</i> , <i>Calytrix microcoma</i> and <i>Myrtella microphylla</i> to, and a moderate groundcover of <i>Triodia bitextura</i> on shallow stony soil.
Q10	7.3	20.42866	144.78748	Dense <i>Acacia shirleyi</i> woodland over a ground cover of <i>Cleistochloa subjuncea</i> , <i>Aristida caput-medusae</i> , <i>Aristida burraensis</i> and <i>Eragrostis</i> sp.
Harp 1	10.1	20.39120	144.78226	Low woodland of <i>Acacia shirleyi</i> with very sparse tussock ground layer of usually <i>Cleistochloa subjuncea</i> or <i>Triodia</i> spp.
Harp 2	10.1	20.39164	144.77814	As per Harp 1
Harp 3	10.5	20.39464	144.78303	Open-woodland to woodland of <i>Corymbia trachyphloia</i> with or without <i>C. lamprophylla</i> usually with shrubby understorey.
Harp 4	10.5	20.39485	144.78155	As per Harp 3
Harp 5	5.9	20.43773	144.85275	Open-woodland of <i>Eucalyptus quadricostata</i> and usually <i>Corymbia brachycarpa</i> and <i>C. leichhardtii</i> with sparse tussock grass ground layer.
Harp 6	7.3	20.44229	144.88949	Woodland of <i>Corymbia lamprophylla</i> and/or <i>Corymbia leichhardtii</i> or sometimes <i>Acacia shirleyi</i> with sparse ground layer of hummock grass <i>Triodia pungens</i> .
Harp 7	5.9	20.45122	144.82616	As per Harp 6
Harp 8	5.9	20.45158	144.82542	As per Harp 6
Gorge camp	10.1	20.39170	144.78232	As per Harp 6
Base camp	7.2	20.45257	144.83671	Low open-woodland of <i>Eucalyptus persistens</i> with sparse cover of hummock grass <i>Triodia bitextura</i> .
Incidental	3.11	-	-	Woodland of <i>Lophostemon suaveolens</i> with <i>Angophora costata</i> in gorges
Incidental	5.1	-	-	Open woodland of <i>Eucalyptus similis</i> usually with <i>Corymbia erythrophloia</i> and a sparse ground layer of hummock grass <i>Triodia pungens</i> .
Incidental	5.4	-	-	Open woodland of <i>Eucalyptus crebra</i> and/or <i>E. drepanophylla</i> with sparse tussock grass ground layer.

four locations, bat detection at one location, two pitfall lines of four buckets each and four lines of 25 Elliott traps) and targeted active searching was undertaken. Active searching included both diurnal observation and spotlighting for nocturnal species. Additional incidental records were collected on a short overnight trip to the Poison Valley section of the White Mountains (by KRMcd). Incidental records of species in the Warang area were collected during a reconnaissance prior to the expedition (by KRMcd, ASK and JEK).

For each quadrat, a range of floristic (species presence and cover), structural (foliage projective cover of strata, basal area, canopy cover), landscape (landform, position, slope, aspect, patch size, location of water-bodies), habitat (soil type and structure, termite mounds, rock, litter, hummock grass, tussock grass, sedge, forb and log cover) and disturbance (fire, feral, weed, erosion impacts) variables were recorded (see detailed methods in Kutt 2004).

The localities of all trapped and incidental species observed during the survey species were geo-coded using a GPS. Voucher specimens of any trapped species unable to be identified were collected and sent to the Queensland Museum for verification. Secondary data sources were also searched to supplement the primary survey data, and two main sources were used: an existing unpublished fauna species list for White Mountains National Park and the Queensland Museum fauna collection database.

Surveys were conducted in the most typical and widespread regional ecosystems of the White Mountains (Table 1), though due to the size of the park and access constraints, sampling was concentrated in small portions of the total reserve area. As with all short fauna surveys, there is a number of limitations that influence the final results. Firstly, this survey sampled a single season for a short period. Consequently, many seasonal and migratory species, or species more active in other seasons (e.g. amphibians) may not have been recorded. Secondly, elusive and trap-shy species or species present in low densities are often only detected in long-term surveys, in some cases over many years. A thorough inventory of all species present in an area is only possible with multiple surveys conducted over many years and seasons.

Analysis

All quadrat and incidental data were assigned a regional ecosystem type (*sensu* Sattler and Williams 1999) by field assessment and intersection with the current Desert Uplands pre-European regional ecosystem mapping available for the region (Queensland Herbarium 2001) (Appendix 1). Calls recorded from the ultrasonic bat detectors were reviewed and identified (by ASK) by comparison with reference sequences recorded for the Desert Uplands bioregion. As the recording periods were not standardised for the survey, only species presence was recorded.

The quadrat and habitat assessment used in the White Mountains was part of a wider survey being conducted throughout the Desert Uplands Bioregion (Kutt 2004). The variation in composition of vertebrate species in all Desert Uplands quadrats (n=158) was examined with

ordination using semi-strong hybrid multi-dimensional scaling (SSHMDS) derived from Bray-Curtis dissimilarity indices (Belbin 1995). Ordinations used range transformed vertebrate abundance data. Only species recorded in more than one quadrat were used. Hierarchical agglomerative clustering was undertaken using the flexible UPGMA routine in PATN (Belbin 1995) and the Bray-Curtis indices. All White Mountains quadrats fell into a single group. Characteristic or typical fauna of the White Mountains fauna group were identified using the SIMPER routine in PRIMER and the Bray-Curtis dissimilarity measures (Clarke and Gorley 2001). SIMPER (similarity percentages) identifies the overall percentage contribution each species makes to the average dissimilarity between two groups (an average of all possible pairs of dissimilarity coefficients, taking one sample from each group), and then lists species in order of importance in discriminating two or more sets of groups (Clarke and Gorley 2001). Only species contributing to a total of 95% of the difference between groups were identified. Principal axis correlation (PCC) was used to examine the correlation of the quadrat habitat measures with the ordination pattern (Belbin 1995). A Monte Carlo randomisation technique (n=500) was used to test the statistical significance of each PCC vector.

Results

Species data

A total of 122 vertebrate fauna species, comprising 50 birds, 6 amphibians, 28 mammals and 38 reptiles, was recorded from the current White Mountains survey (Tables 2-4, Appendix 1). Of these, 53 species (2 birds, 1 amphibian, 27 reptiles and 19 mammals) were new records for the park. This creates a composite species list for White Mountains of 279 species, consisting of 187 birds, 9 amphibians, 28 mammals and 45 reptiles (Appendix 1). Seventeen species were considered to be of conservation significance:

- Masked Owl *Tyto novaehollandiae kimberli* vulnerable (EPBC 1999) and (QNCA 1997);
- Squatter Pigeon *Geophaps scripta scripta* and Black-throated Finch *Poephila cincta cincta*, both vulnerable (EPBC 1999) and rare (QNCA 1997);
- Grey Goshawk *Accipiter novaehollandiae*, Square-tailed Kite *Lophoictinia isura*, Common Death Adder *Acanthophis antarcticus* and the Two-toed Fine-lined Slider *Lerista wilkinsi*, all rare (QNCA 1997);
- Koala *Phascolarctos cinereus*, cultural significance (QNCA 1997);
- Spectacled Hare-wallaby *Lagorchestes conspicillatus*, near threatened (Maxwell et al. 1996);
- White-eared Honeyeater *Lichenostomus leucotis*, Inland/Brown Thornbill *Acanthiza apicalis/pusilla*, Pebble-mound Mouse *Pseudomys patrius*, Desert Mouse *Pseudomys desertor*, Desert Uplands Ctenopus *Ctenopus rosarium*, Speckled Worm-skink *Anomalopus gowi*, Large Toadlet *Pseudophryne major* and Stonemason Toadlet *Uperoleia lithomoda*, all of bioregional significance for the Desert Uplands (Morgan et al. 2003).

Table 2. Species recorded in quadrat samples (Q1-Q10), including total abundance. Data in last column identifies the fauna species that help distinguish the White Mountains grouping (see description of SIMPER routine in Methods). * indicates a species recorded only in the White Mountains quadrats in comparison to other samples in the Desert Uplands. Quadrats locations and habitat identified in Appendix 1. # identification of this species not confirmed.

Species	Common name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Group
Birds												
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	1										
<i>Cracticus nigrogularis</i>	Pied Butcherbird						1				1	
<i>Cracticus torquatus</i>	Grey Butcherbird	1		3	2		1	1	1			5.1
<i>Gymnorhina tibicen</i>	Australian Magpie		1	2			1	1		2	4	4.3
<i>Strepera graculina</i>	Pied Currawong	3	2				1	1	3	2	9	7.1
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike						1		1			
<i>Coracina papuensis</i>	White-bellied Cuckoo-Shrike						1		5			
<i>Eurostopodus mystacalis</i>	White-throated Nightjar							1				
<i>Corvus coronoides</i>	Australian Raven	3						1				
<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo							1				
<i>Chrysococcyx lucidus</i>	Shining Bronze-Cuckoo	1										
<i>Rhipidura fuliginosa</i>	Grey Fantail					1						
<i>Dacelo novaeguineae</i>	Laughing Kookaburra				2				1		6	1
<i>Todiramphus sanctus</i>	Sacred Kingfisher		1									
<i>Malurus melanocephalus</i>	Red-backed Fairy-wren	6										
<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater					2						
<i>Lichmera indistincta</i>	Brown Honeyeater	8	15	2	1	9	8	14				10.2
<i>Manorina melanocephala</i>	Noisy Miner			6								*
<i>Melithreptus albigularis</i>	White-throated Honeyeater	1	4	4	5	5	6					6.2
<i>Philemon citreogularis</i>	Little Friarbird			2				1				
<i>Philemon corniculatus</i>	Noisy Friarbird		2	5	5	11	12	4			10	10.9
<i>Plectorhyncha lanceolata</i>	Striped Honeyeater							2				
<i>Oriolus sagittatus</i>	Olive-backed Oriole										1	
<i>Colluricincla harmonica</i>	Grey Shrike-Thrush	1	3		2			3			1	2.9
<i>Pachycephala rufiventris</i>	Rufous Whistler		1	1	1	3			1	1		4.2
<i>Acanthiza pusilla/apicalis</i> #	Brown/Inland Thornbill							2				*
<i>Acanthiza reguloides</i>	Buff-rumped Thornbill	4				8				2		1.4
<i>Pardalotus striatus</i>	Striated Pardalote	3				6	1	2	4		2	4.9
<i>Smicromis brevirostris</i>	Weebill	2		4	3	5	6		8	12	4	13.4
<i>Microeca fascians</i>	Jacky Winter					1						
<i>Podargus strigoides</i>	Tawny Frogmouth										1	
Amphibians												
<i>Litoria caerulea</i>	Green Tree Frog					1				1		
<i>Uperoleia lithomoda</i>	Stonemason Gungan							1				
Mammals												
<i>Planigale maculata</i>	Common Planigale		1		1		1			1		1.6
<i>Pseudomys delicatulus</i>	Delicate Mouse	2	3	8	5	8	2					6.3
<i>Pseudomys desertor</i>	Desert Mouse				1	2				6		0.9
<i>Pseudomys patrius</i>	Pebble-mound Mouse							3	1	2	2	2.0
Reptiles												
<i>Diplodactylus conspicillatus</i>	Fat-tailed Diplodactylus			1								
<i>Diplodactylus steindachneri</i>	Box-patterned gecko								1	4		
<i>Diplodactylus vittatus</i>	Wood Gecko	1							1		3	0.8

Species	Common name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Group
<i>Diplodactylus williamsi</i>	gecko											
<i>Heteronotia binoei</i>	Bynoe's Gecko											
<i>Nephurus asper</i>	Rough Knob-tail							2				
<i>Oedura castelnaui</i>	Northern Velvet Gecko				2							1.5
<i>Oedura rhombifer</i>	Zigzag Velvet Gecko		3						3			
<i>Lialis burtonis</i>	Burton's Legless Lizard											
<i>Pygopus schraderi</i>	Hooded Scaly Foot											
<i>Diporiphora australis</i>	Eastern Two-line Dragon			4		2						1.6
<i>Carlia munda</i>	Shaded-litter Rainbow-skink											
<i>Carlia schmeltzii</i>	Robust Rainbow-skink	2										*
<i>Ctenotus pantherinus</i>	Leopard Ctenotus											
<i>Ctenotus rosarium</i>	Desert Uplands Ctenotus											
<i>Glaphyromorphus punctulatus</i>	Fine-spotted Mulch-skink											*
<i>Lerista muelleri</i>	Wood Mulch-slider											1.5
<i>Lerista wilkinsi</i>	Two-toed Fine-lined Slider											*
<i>Lygisaurus foliorum</i>	Tree-base Litter-skink											*
<i>Menetia greyii</i>	Common Dwarf Skink											
<i>Menetia timlowi</i>	skink			2							4	4.2
<i>Morethia taeniopleura</i>	Fire-tailed Skink											
<i>Proablepharus tenuis</i>	Northern Soil-crevice Skink					3						2.7

Table 3. List of microchiropteran bat species recorded at White Mountains in harp traps (H1-H8) and via Anabat detecting (Base, Gorge, Q1-Q10). Column headings refer to trap and detection locations listed in Appendix 1. Numbers of individuals caught given for trap sites, but presence only is listed for bat detecting. * indicates current taxonomic status uncertain.

Species	Common name	H1	H2	H3	H4	H5	H6	H7	H8	Base	Gorge	Q1	Q2	Q4	Q6	Q7	Q8	Q10
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail bat									*			*	*			*	
<i>Taphozous georgianus/troughtoni</i> *	Common/Troughton's Sheath-tail bat										*							
<i>Chaerephon jobensis</i>	Northern Mastiff bat										*							
<i>Mormopterus beccarii</i>	Beccari's Freetail bat									*			*				*	
<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe-bat									*			*					
<i>Chalinolobus gouldii</i>	Goulds Wattled bat									*								
<i>Miniopterus australis</i>	Little Bent-wing Bat	7									*			*				
<i>Miniopterus schreibersii</i>	Common Bent-wing Bat	14		26						*	*	*	*				*	*
<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat																	*
<i>Scotorepens greyii</i>	Inland Broad-nosed bat									*						*		
<i>Vespadelus troungtoni</i>	Eastern Cave Bat	4	17	2					6	*	*	*	*	*	*	*	*	*

Table 4. List of species recorded incidentally throughout the survey period, including abundance and regional ecosystem type. Descriptions for regional ecosystems in Table 1.

Species	Common name	10.1	10.4	10.5	3.11	5.1	5.4	5.9	7.2	7.3	7.7
Birds											
<i>Accipiter fasciatus</i>	Brown Goshawk										
<i>Aquila audax</i>	Wedge-tailed Eagle										
<i>Milvus migrans</i>	Black Kite										
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar										
<i>Cracticus torquatus</i>	Grey Butcherbird										
<i>Gymnorhina tibicen</i>	Australian Magpie										
<i>Strepera graculina</i>	Pied Currawong		2					2			

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Species	Common name	10.1	10.4	10.5	3.11	5.1	5.4	5.9	7.2	7.3	7.7
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike		1								
<i>Centropus phasianinus</i>	Pheasant Coucal	2								1	
<i>Geopelia striata</i>	Peaceful Dove	1									
<i>Phaps chalcoptera</i>	Common Bronzewing									1	
<i>Struthidea cinerea</i>	Apostlebird								1		
<i>Corvus coronoides</i>	Australian Raven	2									
<i>Dicaeum hirundinaceum</i>	Mistletoebird	1									
<i>Dicrurus bracteatus</i>	Spangled Drongo	1									
<i>Myiagra inquieta</i>	Restless Flycatcher	1									
<i>Rhipidura fuliginosa</i>	Grey Fantail	1	1								
<i>Rhipidura leucophrys</i>	Willie Wagtail								1		
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	1									
<i>Lichmera indistincta</i>	Brown Honeyeater					3					
<i>Melithreptus albogularis</i>	White-throated Honeyeater	1									
<i>Philemon citreogularis</i>	Little Friarbird							4			
<i>Philemon corniculatus</i>	Noisy Friarbird	1									
<i>Merops ornatus</i>	Rainbow Bee-eater	1							1		
<i>Oriolus sagittatus</i>	Olive-backed Oriole	1									
<i>Ardeotis australis</i>	Australian Bustard		2								
<i>Colluricincla harmonica</i>	Grey Shrike-Thrush	1									
<i>Pachycephala rufiventris</i>	Rufous Whistler	1									
<i>Acanthiza reguloides</i>	Buff-rumped Thornbill		3								
<i>Pardalotus striatus</i>	Striated Pardalote	1									
<i>Taeniopygia bichenovii</i>	Double-barred Finch								3		
<i>Podargus strigoides</i>	Tawny Frogmouth	2			1					1	
<i>Platycercus adscitus</i>	Pale-headed Rosella	1						4			
<i>Ninox novaeseelandiae</i>	Southern Boobook	3			1						
<i>Tyto novaehollandiae</i>	Masked Owl	1									
Amphibians											
<i>Bufo marinus</i>	Cane Toad						1				
<i>Cyclorana novaehollandiae</i>	New Holland Frog						1			1	
<i>Litoria caerulea</i>	Green Tree Frog									1	
<i>Litoria inermis</i>	Bumpy Rocketfrog					1					
<i>Litoria latopalmata</i>	Broad-palmed Rocketfrog				1	1					
<i>Litoria rubella</i>	Naked Treefrog						1				
<i>Limnodynastes ornatus</i>	Ornate Burrowing-Frog				1	1	1				
Mammals											
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtailed-bat								1		
<i>Macropus robustus</i>	Wallaroo									2	
<i>Macropus rufus</i>	Red Kangaroo								1		
<i>Wallabia bicolor</i>	Swamp Wallaby					1					
<i>Chaerephon jobensis</i>	Northern Freetail-bat				1						
<i>Pseudomys patrius</i>	Pebble-mound Mouse					1				2	
<i>Rattus sordidus</i>	Canefield Rat	2									
<i>Zyzomys argurus</i>	Common Rock-rat			2							
<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe-bat			2				2			
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna			1							
<i>Miniopterus australis</i>	Little Bent-wing Bat	7		11							
<i>Miniopterus schreibersii</i>	Common Bent-wing Bat	14		27							

Species	Common name	10.1	10.4	10.5	3.11	5.1	5.4	5.9	7.2	7.3	7.7
<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat										
<i>Vespudelus troughtoni</i>	Eastern Cave Bat	2		13				7			
Reptiles											
<i>Chlamydosaurus kingii</i>	Frill-necked Lizard										
<i>Elseya latisternum</i>	Eastern Snapping Turtle										
<i>Dendrelaphis punctulata</i>	Common Tree Snake										
<i>Acanthopis antarcticus</i>	Common Death Adder										
<i>Furina ornata</i>	Orange-naped Snake										
<i>Pseudonaja textilis</i>	Eastern Brown Snake										
<i>Diplodactylus conspicillatus</i>	Fat-tailed Diplodactylus										
<i>Diplodactylus steindachneri</i>	Box-patterned gecko							2		2	
<i>Gehyra dubia</i>	Dubious dtella										
<i>Heteronotia binoei</i>	Bynoe's Gecko						3				
<i>Nephurus asper</i>	Rough Knob-tail							2			
<i>Oedura castelnaui</i>	Northern Velvet Gecko						2	6			
<i>Oedura monilis</i>	Ocellated Velvet Gecko										
<i>Anomalopus gowi</i>	Speckled Worm-skink										
<i>Carlia munda</i>	Shaded-litter Rainbow-skink										
<i>Carlia schmeltzii</i>	Robust Rainbow-skink										
<i>Cryptoblepharus carnabyi</i>	Spiny-palmed Shinning-skink										
<i>Ctenotus spaldingi</i>	Straight-browed Ctenotus										
<i>Eulamprus sokosoma</i>	Barred-sided Skink							2			
<i>Menetia greyii</i>	Common Dwarf Skink										

Assemblage patterns

Sixty species (33 birds, 2 amphibians, 4 mammals and 23 reptiles) were recorded from the standardised quadrats. Classification of these and all other unique Desert Uplands quadrats by their species composition identified 13 groups, of which all the White Mountains quadrats fell into one distinct group (Figure 2). Compared to other sites in the Desert Uplands the characteristic fauna of the White Mountains include the Weebill *Smicromis brevirostris*, Brown Honeyeater *Lichmera indistincta*, Grey Butcherbird *Cracticus torquatus*, Noisy Friarbird *Philemon corniculatus*, Pied Currawong *Strepera graculina*, White-throated Honeyeater *Meliphaga albogularis*, Delicate Mouse *Pseudomys delicatulus*, Pebble-mound Mouse *P. patrius*, Common Planigale *Planigale maculata*, and the reptiles *Menetia timlowi*, *Diporiphora australis*, *Proablepharus tenuis*, *Lerista muelleri* and *Oedura castelnaui* (Table 2). In addition, species such as the Noisy Miner *Manorina melanoccephala* and the reptiles *Carlia schmeltzii*, *Lygisaurus foliorum*, *Glaphyromorphus punctulatus*, *Lerista wilkinsi* were recorded only in the White Mountains in comparison to the entire Desert Uplands quadrat data set (Table 2).

The ordination using vertebrate species composition identified the White Mountains as distinct cluster, separated from the large amalgamation of sites in the centre of the ordination. These central quadrats represent a mix of open *Eucalyptus* woodland communities and distinct from sites on the right hand side of the ordination which represent tussock and hummock grassland sites (Figure 3). Vector fitting of the environmental variables indicate that the

White Mountains quadrats were significantly correlated with higher values for altitude, canopy height, litter cover and foliage projective cover (3-5 m height category) than the other Desert Uplands sites.

Discussion

Patterns of fauna assemblage

The composition and species richness of the vertebrate fauna of the Desert Uplands bioregion is typical of the semi-arid savannas of northern Australia. There is a mixture of species representative of the range of vegetation structural types with a high fidelity of some assemblages and species to particular habitat types and environmental extremes (e.g. grasslands) (Kutt 2004). The most diverse habitats are the open woodlands, which are characterised by having a core assemblage of species that vary in abundance with relatively subtle environmental shifts (e.g. sand to clay soils, *Acacia* versus *Eucalyptus* dominance, hummock versus tussock ground cover) (Kutt 2004). Most of the vertebrate fauna species recorded at White Mountains in this survey were typical of these *Eucalyptus* and *Acacia* woodlands of the Desert Uplands, though the White Mountains quadrat samples as a group were on the periphery of the cluster of Desert Uplands woodland sites.

The species characteristic of the White Mountains quadrats (with the exception of the five unique species identified earlier), were all recorded elsewhere in the Desert Uplands. The characteristic species of the White Mountains grouping and others recorded in lower

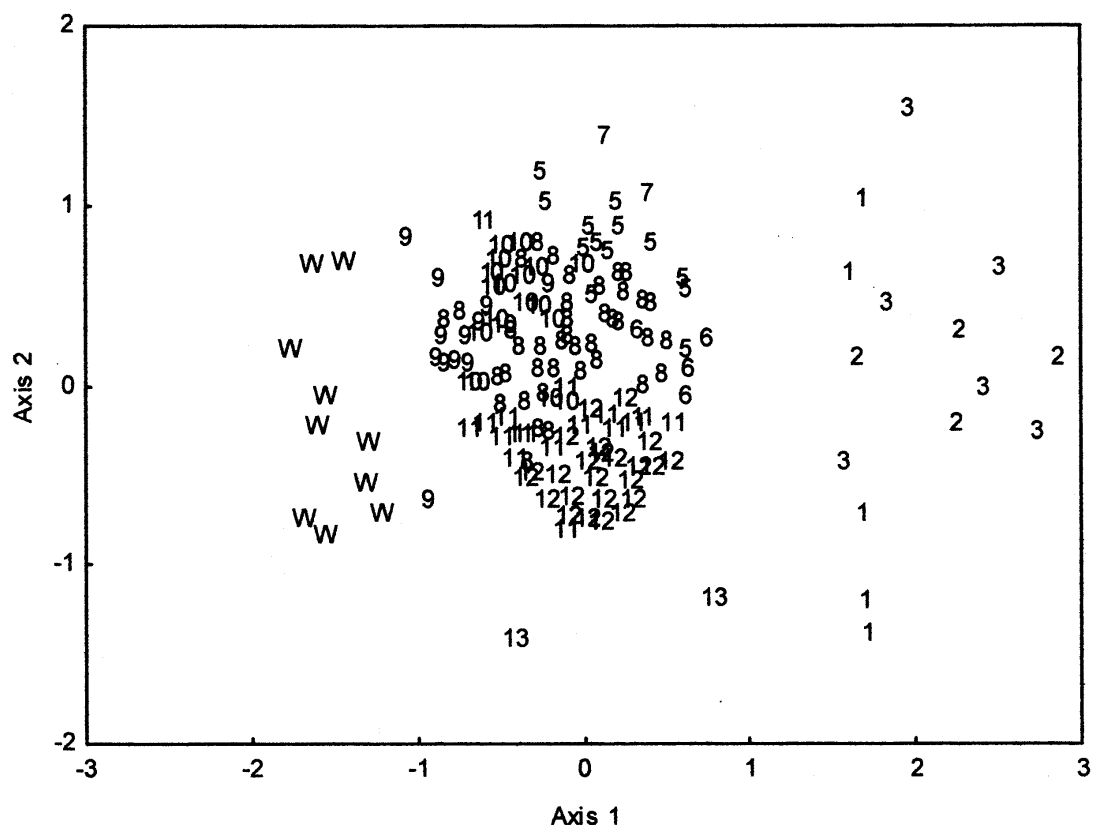


Figure 2 Two dimensional ordination of all quadrats sampled in the Desert Uplands Bioregion by their vertebrate species composition using semi-strong hybrid multi-dimensional scaling (stress=0.32). Data were standardised and species recorded in only one quadrat were removed from the analysis. W indicates the White Mountains group, while the numbers represent all other quadrats and fauna groups.

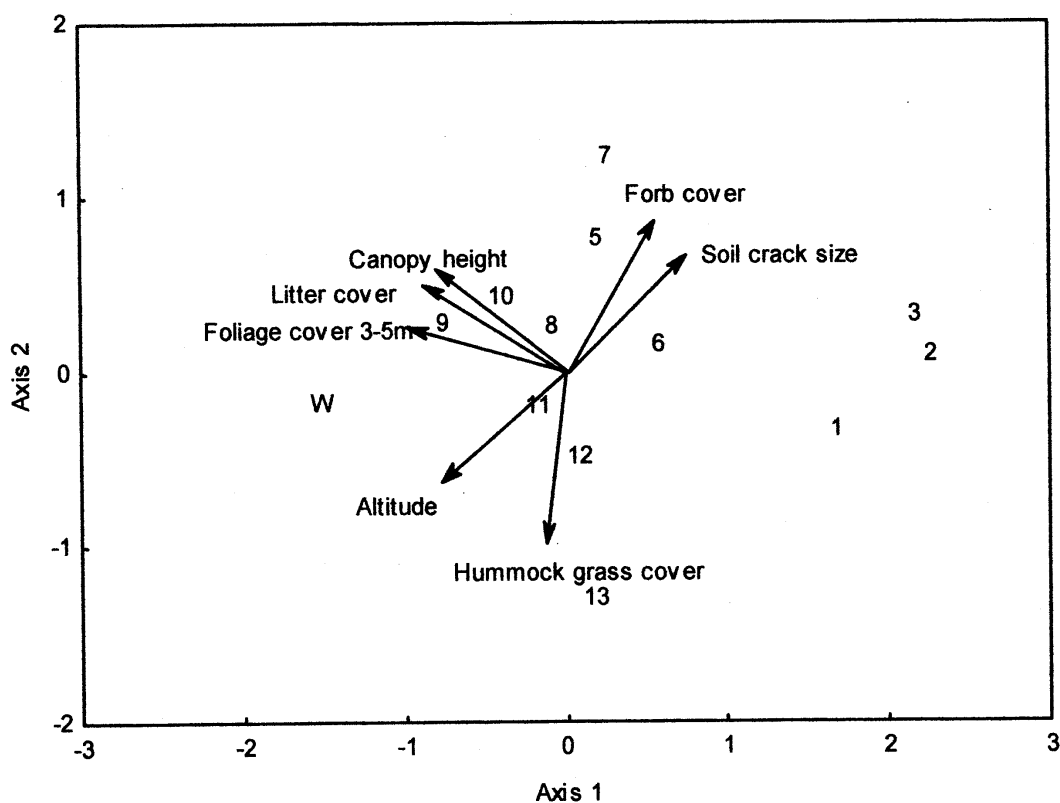


Figure 3 Two-dimensional ordination of quadrats by fauna composition illustrating the direction of the most significant environmental vectors identified via the PCC. Numbers (and W) indicate fauna group centroid. All vectors presented are significant at $p < 0.001$ level.

abundances in the quadrats are either predominantly distributed in north-eastern Queensland (e.g. White-throated Nightjar *Eurostopodus mystacalis*, Blue-faced Honeyeater *Entomyzon cyanotis*, *Uperoleia lithomoda*, *Carlia munda*) or are widespread generalists (e.g. Rufous Whistler *Pachycephala rufiventris*, Grey Fantail *Rhipidura fuliginosa*, Australian Owlet-nightjar *Aegotheles cristatus*, *Macropus robustus*, *Lialis burtoni*, *Menetia greyii*, *Diplodactylus steindachneri*). Four of the five species recorded only in the White Mountains (Noisy Miner, *Carlia schmeltzii*, *Lygisaurus foliorum*, *Glaphyromorphus punctulatus*) in comparison to the larger Desert Uplands bioregional survey (Kutt 2004), are also more strongly affiliated to coastal and near coastal habitats. *Lerista wilkinsi* is currently known only from a small area surrounding the White Mountains region.

White Mountains lie on the northern end of the Alice Tableland, the highest part of the Desert Uplands (750 m compared to an average of 300-400 m) and continuous with the Einasleigh Uplands. This may be expected to influence the overall composition of the fauna, both climatically (higher rainfall, wider temperature extremes and resultant mesic woodland vegetation compared to the more semi-arid southern areas of the Desert Uplands) and via a physical connection to the adjacent Einasleigh area. The expectation then is perhaps for a more Torresian and mesic flavour to the White Mountains fauna, and a greater variety of species, being positioned at the intersection of a sub-tropical and a semi-arid bioregion. This is borne out to some degree by the presence of a number of species distributed more typically in the northern Queensland tropical savannas (e.g. *Anomalopus gowi*, *Uperoleia lithomoda*, *Chaerephon jobensis*), more mesic east coastal environments (e.g. Noisy Miner, Pied Currawong, *Glaphyromorphus punctulatus*, *Planigale maculata*, *Rattus sordidus*) and species distributed generally within and west of the Desert Uplands (e.g. *Pseudomys desertor*, *Ctenotus rosarium*, *Gehyra variegata*, *Lerista wilkinsi*). The biogeographic significance of this Einasleigh/Desert Uplands boundary has been recognised both as a geographical barrier (Burdekin-Lynd Divide) and a significant area of avian speciation (Ford 1986; Schodde and Mason 1999). It also lies on the Great Dividing Range, the nominal division between the Eyrean and Torresian zoogeographical regions, and hence the inland and coastal faunas of Australia (Spencer 1896; Burbidge 1960).

A few of the significant environment vectors on the ordination partly help account for predominance of some groups of fauna species. The high number of fossorial skinks (*Proablepharus tenuis*, *Lygisaurus foliorum*, *Menetia timlowi*, *M. greyii*, *Glaphyromorphus punctulatus*, *Lerista muelleri*, *L. wilkinsi*) possibly corresponds to the high litter cover recorded in the quadrats. Fossorial species require litter and shrub cover and generally decline with the increase of bare ground (Caughley 1985; Thurgate 1997; Fisher 2001; Woinarski et al. 2002). Similarly the moderate abundance of foliage gleaning and nectivorous birds such as Weebill, Buff-rumped Thornbill, Grey Shrike-thrush, Brown Honeyeater, White-throated Honeyeater, Noisy Friarbird and Grey Fantail, may have some relationship with the tall canopy and high foliage projective cover of

the mid-strata recorded (promoted by the *Acacia*/heath vegetation types). These birds have all been reported as being more abundant sites with more complex vertical structure (Woinarski and Fisher 1995; Catterall et al. 1997; Catterall et al. 2001; Fisher 2001).

Birds

The avian fauna composition recorded for White Mountains during the current survey was in typical for north-eastern Australian woodlands. Foliage gleaners and salliers (Weebill, Rufous Whistler, Black-faced Cuckoo-shrike, Grey Shrike-thrush, Jacky Winter, Grey Fantail), nectarivores (friarbird species, Singing Honeyeaters, Brown Honeyeater) and terrestrial insectivores and omnivores (butcherbird species, miner species, wren species) predominate many open woodlands of this region (Kutt 2004). The incidental bird list for the White Mountains recorded by the QPWS is much more extensive, obviously reflecting an accumulation of incidental and seasonal records over a longer time period. However, there are numerous vagrant and wetland species and likely many of the species listed are represented by single records, or in the case of water birds, those recorded at dams and artificial water-bodies, and not a true representation of the White Mountains fauna. The core species most abundant and resident in the area is likely much less than those represented in Appendix 2.

Mammals

The ground-dwelling mammal fauna for White Mountains was largely unknown prior to this survey. Five rodents and one dasyurid were recorded in this survey with two species being outliers or at the edge of their range (*Rattus sordidus*, *Planigale maculata*) and two species being rock-dwelling or rocky escarpment specialists (*Pseudomys patrius*, *Zygomys argurus*). Other species known to be common in the Desert Uplands and the region (Striped-faced Dunnart *Sminthopsis macroura*, Common Dunnart *Sminthopsis murina*) have yet to be recorded and are likely to be found with continued survey effort. The gorge habitat also seems ideal and within range of the Northern Quoll *Dasyurus hallucatus* and this species was collected in the region in the 1920s (Wilkins 1926). More recent anecdotal information exists of *D. hallucatus* in the White Mountains area (ASK unpubl. data), though this species was not recorded during the survey, and has declined markedly throughout its range since the introduction and spread of the Cane Toad (Braithwaite and Griffith 1994; Burnett 1997).

The arboreal mammal fauna diversity was typical for semi-arid woodlands of north-eastern Queensland with only Koalas *Phascolarctos cinereus*, Sugar Gliders *Petaurus breviceps* and Common Brushtail Possums *Trichosurus vulpecula* recorded (Munks 1996). However, the woodlands of White Mountains are well developed and continuous with extensive tall woodlands more typical of the Einasleigh Uplands and the Great Dividing Range. Greater Gliders *Petauroides volans* have been recorded in tall Lemon-scented gum *Eucalyptus citriodora* woodlands adjacent to the north-west of the White Mountains (ASK pers. obs.) and Squirrel Gliders *Petaurus norfolcensis* to the south-east in Poplar Box/Ironbark woodlands continuous with the Burra Range (Kutt 2004).

The microchiropteran bat fauna, as expected, contained a large suite of cave-roosting species: *Vespudelus troungtoni*, *Taphozous* sp., *Miniopterus australis*, *M. schreibersii* and *Rhinolophus megaphyllus*. Of the remaining species, most were larger, widespread northern and central Australian bats, such as *Saccolaimus flaviventris*, *Chaerephon jobensis*, *Chalinolobus gouldii* and *Mormopterus beccarii*. Admittedly, given the extensive cave and cliff systems and well-developed escarpment and gorge woodlands, the bat fauna was less diverse than expected. Weather at the time of survey was unseasonably wet and cool, perhaps influencing the number of species recorded.

Reptiles

The reptile fauna of the Desert Uplands bioregion is diverse (n=111), almost equable to the species rich Wet Tropics (n=132) and known centres of reptile radiation, such as the Channel Country (n=136) (Kutt 2004). The reptile fauna of the White Mountains reflects the diversity of the bioregion, and as highlighted previously, there is a distinct suite of small fossorial skink and gecko species. The serpent fauna is probably under-sampled, as snakes are generally more cryptic and difficult to find or trap. During the period of survey, the weather was cooler and more overcast than was expected for the time of year, and this possibly influenced the low number of large ectotherms encountered. Overall the reptile fauna reflects a strong Torresian relationship.

Frogs

During the 1990s the Queensland Parks and Wildlife Service and the Queensland Museum made several frog collections in the White Mountains (by KMCD). Most sites were along the highway and adjacent areas as it passes through the south-eastern part of the park. Twelve species, comprising

63% of the Desert Uplands frogs, have been recorded with only one, *Pseudophryne major*, representing a disjunct record. This species is known from a collection in the sandstone gorges northeast of Warang. All other frog records were typical of widespread species occurring in semi-arid habitats of northern Queensland. The White Mountains survey recorded nine species, none of which were an extension of range or an addition to the park. Conditions at the time were dry with frog activity minimal and future frog surveys should concentrate on summer wet season activity especially for burrowing frogs, which are easily detected after thunderstorms or periods of heavy rainfall.

Conclusion

White Mountains National Park is a significant reserve within Queensland's protected area estate. It lies at the confluence of multiple major landscape features and the composition of the fauna assemblage reflects this position at climatic and biogeographic crossroads in the semi-arid tropical savannas. The mesic gorges and tall high altitude *Eucalyptus* forests provide habitat for species with typical distributions tending further east and south (e.g. White-throated Nightjar, Noisy Miner, *Wallabia bicolor*, *Rattus sordidus*, *Planigale maculata*, *Nyctophilus gouldi*, *Diplodactylus vittatus*, *Glaphyromorphus punctulatus*). There is also a more xeric suite of fauna that becomes more abundant in the western Desert Uplands and beyond (e.g. *Pseudomys desertor*, *Ctenotus pantherinus*, *Ctenotus rosarium*, *Gehyra variegata*). Accurate documentation of the terrestrial vertebrate fauna species of any area generally requires long-term survey, particularly for cryptic, low abundance and seasonal species. Future survey will undoubtedly provide additional data for the region, including unusual and significant fauna species.

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APPENDIX I

Appendix I Composite species list for White Mountains National Park derived from the current survey (CURR) and from an unpublished Queensland Parks and Wildlife Service species list for the park (QPWS).

Family	Species	Common name	CURR	QPWS
Birds				
Accipitridae	<i>Accipiter cirrhocephalus</i>	Collared Sparrowhawk		*
Accipitridae	<i>Accipiter fasciatus</i>	Brown Goshawk	*	*
Accipitridae	<i>Accipiter novaehollandiae</i>	Grey Goshawk		*
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle	*	*
Accipitridae	<i>Aviceda subcristata</i>	Pacific Baza		*
Accipitridae	<i>Circus assimilis</i>	Spotted Harrier		*
Accipitridae	<i>Elanus axillaris</i>	Black-shouldered Kite		*
Accipitridae	<i>Elanus scriptus</i>	Letter-winged Kite		*
Accipitridae	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		*
Accipitridae	<i>Hamirostra melanosternon</i>	Black-breasted Buzzard		*
Accipitridae	<i>Hieraaetus morphnoides</i>	Little Eagle		*
Accipitridae	<i>Lophoictinia isura</i>	Square-tailed Kite		*
Accipitridae	<i>Milvus migrans</i>	Black Kite	*	*
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	*	*
Alaudidae	<i>Mirafra javanica</i>	Singing Bushlark		*
Anatidae	<i>Anas gracilis</i>	Grey Teal		*
Anatidae	<i>Anas superciliosa</i>	Pacific Black Duck		*
Anatidae	<i>Chenonetta jubata</i>	Australian Wood Duck		*
Anatidae	<i>Dendrocygna arcuata</i>	Wandering Whistling-Duck		*
Anatidae	<i>Dendrocygna eytoni</i>	Plumed Whistling-Duck		*
Anhingidae	<i>Anhinga melanogaster</i>	Darter		*
Apodidae	<i>Hirundapus caudacutus</i>	White-throated Needletail		*
Ardeidae	<i>Ardea alba</i>	Great Egret		*
Ardeidae	<i>Ardea garzetta</i>	Little Egret		*
Ardeidae	<i>Ardea ibis</i>	Cattle Egret		*
Ardeidae	<i>Ardea intermedia</i>	Intermediate Egret		*
Ardeidae	<i>Ardea pacifica</i>	White-necked Heron		*
Ardeidae	<i>Nycticorax caledonicus</i>	Nankeen Night Heron		*
Artamidae	<i>Artamus cinereus</i>	Black-faced Woodswallow		*
Artamidae	<i>Artamus cyanopterus</i>	Dusky Woodswallow		*
Artamidae	<i>Artamus leucorhynchus</i>	White-breasted Woodswallow		*
Artamidae	<i>Artamus minor</i>	Little Woodswallow		*
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow		*
Artamidae	<i>Artamus superciliosus</i>	White-browed Woodswallow		*
Artamidae	<i>Cracticus nigrogularis</i>	Pied Butcherbird	*	*
Artamidae	<i>Cracticus torquatus</i>	Grey Butcherbird	*	*
Artamidae	<i>Gymnorhina tibicen</i>	Australian Magpie	*	*
Artamidae	<i>Strepera graculina</i>	Pied Currawong	*	*
Burhinidae	<i>Burhinus grallarius</i>	Bush Stone-Curlew		*
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo		*
Cacatuidae	<i>Cacatua roseicapilla</i>	Galah		*
Cacatuidae	<i>Calyptorhynchus banksii</i>	Red-tailed Black Cockatoo		*
Cacatuidae	<i>Nymphicus hollandicus</i>	Cockatiel		*
Campephagidae	<i>Coracina maxima</i>	Ground Cuckoo-shrike		*
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	*	*
Campephagidae	<i>Coracina papuensis</i>	White-bellied Cuckoo-Shrike	*	*

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Family	Species	Common name	CURR	QPWS
Campephagidae	<i>Coracina tenuirostris</i>	Cicadabird		*
Campephagidae	<i>Lalage sueurii</i>	White-winged Triller		*
Caprimulgidae	<i>Eurostopodus argus</i>	Spotted Nightjar		*
Caprimulgidae	<i>Eurostopodus mystacalis</i>	White-throated Nightjar	*	*
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu		*
Centropodidae	<i>Centropus phasianinus</i>	Pheasant Coucal	*	*
Charadriidae	<i>Elseyornis melanops</i>	Black-fronted Dotterel		*
Charadriidae	<i>Vanellus miles</i>	Masked Lapwing		*
Charadriidae	<i>Vanellus tricolor</i>	Banded Lapwing		*
Climacteridae	<i>Climacteris picumnus</i>	Brown Treecreeper		*
Columbidae	<i>Geopelia cuneata</i>	Diamond Dove		*
Columbidae	<i>Geopelia humeralis</i>	Bar-shouldered Dove		*
Columbidae	<i>Geopelia striata</i>	Peaceful Dove	*	*
Columbidae	<i>Geophaps plumifera</i>	Spinifex Pigeon		*
Columbidae	<i>Geophaps scripta</i>	Squatter Pigeon		*
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing	*	*
Columbidae	<i>Phaps histrionica</i>	Flock Bronzewing		*
Coraciidae	<i>Eurystomus orientalis</i>	Dollarbird		*
Corcoracidae	<i>Corcorax melanorhamphos</i>	White-winged Chough		*
Corcoracidae	<i>Struthidea cinerea</i>	Apostlebird	*	*
Corvidae	<i>Corvus bennetti</i>	Little Crow		*
Corvidae	<i>Corvus coronoides</i>	Australian Raven	*	*
Corvidae	<i>Corvus orru</i>	Torresian Crow		*
Cuculidae	<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo	*	*
Cuculidae	<i>Chrysococcyx lucidus</i>	Shining Bronze-Cuckoo	*	*
Cuculidae	<i>Chrysococcyx osculans</i>	Black-eared Cuckoo		*
Cuculidae	<i>Cuculus flabelliformis</i>	Fan-tailed Cuckoo		*
Cuculidae	<i>Cuculus pallidus</i>	Pallid Cuckoo		*
Cuculidae	<i>Eudynamys scolopacea</i>	Common Koel		*
Cuculidae	<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo		*
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird	*	*
Dicruridae	<i>Dicrurus bracteatus</i>	Spangled Drongo	*	
Dicruridae	<i>Grallina cyanoleuca</i>	Magpie Lark		*
Dicruridae	<i>Monarcha melanopsis</i>	Black-faced Monarch		*
Dicruridae	<i>Myiagra inquieta</i>	Restless Flycatcher	*	*
Dicruridae	<i>Myiagra rubecula</i>	Leaden Flycatcher		*
Dicruridae	<i>Rhipidura fuliginosa</i>	Grey Fantail	*	*
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail	*	*
Falconidae	<i>Falco berigora</i>	Brown Falcon		*
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel		*
Falconidae	<i>Falco hypoleucos</i>	Grey Falcon		*
Falconidae	<i>Falco longipennis</i>	Australian Hobby		*
Falconidae	<i>Falco peregrinus</i>	Peregrine Falcon		*
Falconidae	<i>Falco subniger</i>	Black Falcon		*
Gruidae	<i>Grus rubicunda</i>	Brolga		*
Halcyonidae	<i>Dacelo leachii</i>	Blue-winged Kookaburra		*
Halcyonidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	*	*
Halcyonidae	<i>Todiramphus macleayii</i>	Forest Kingfisher		*
Halcyonidae	<i>Todiramphus pyrrhopygia</i>	Red-backed Kingfisher		*

Family	Species	Common name	CURR	QPWS
Halcyonidae	<i>Todiramphus sanctus</i>	Sacred Kingfisher	*	*
Hirundinidae	<i>Hirundo ariel</i>	Fairy Martin		*
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow		*
Hirundinidae	<i>Hirundo nigricans</i>	Tree Martin		*
Laridae	<i>Chlidonias hybrida</i>	Whiskered Tern		*
Maluridae	<i>Malurus lamberti</i>	Varigated Fairy-wren		*
Maluridae	<i>Malurus melanocephalus</i>	Red-backed Fairy-wren	*	*
Megapodiidae	<i>Alectura lathami</i>	Australian Brush-turkey		*
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater		*
Meliphagidae	<i>Certhionyx niger</i>	Black Honeyeater		*
Meliphagidae	<i>Certhionyx variegatus</i>	Pied Honeyeater		*
Meliphagidae	<i>Conopophila rufogularis</i>	Rufous-throated Honeyeater		*
Meliphagidae	<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater	*	*
Meliphagidae	<i>Epthianura tricolor</i>	Crimson Chat		*
Meliphagidae	<i>Lichenostomus leucotis</i>	White-eared Honeyeater		*
Meliphagidae	<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater		*
Meliphagidae	<i>Lichenostomus plumulus</i>	Grey-fronted Honeyeater		*
Meliphagidae	<i>Lichenostomus virescens</i>	Singing Honeyeater		*
Meliphagidae	<i>Lichmera indistincta</i>	Brown Honeyeater	*	*
Meliphagidae	<i>Manorina flavigula</i>	Yellow-throated Miner		*
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner	*	*
Meliphagidae	<i>Melithreptus albogularis</i>	White-throated Honeyeater	*	*
Meliphagidae	<i>Melithreptus gularis</i>	Black-chinned Honeyeater		*
Meliphagidae	<i>Melithreptus lunatus</i>	White-naped Honeyeater		*
Meliphagidae	<i>Philemon argenticeps</i>	Silver-crowned Friarbird		*
Meliphagidae	<i>Philemon buceroides</i>	Helmeted Friarbird		*
Meliphagidae	<i>Philemon citreogularis</i>	Little Friarbird	*	*
Meliphagidae	<i>Philemon corniculatus</i>	Noisy Friarbird	*	*
Meliphagidae	<i>Phylidonyris albifrons</i>	White-fronted Honeyeater		*
Meliphagidae	<i>Plectorhyncha lanceolata</i>	Striped Honeyeater	*	*
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater	*	*
Motacillidae	<i>Anthus novaeseelandiae</i>	Richard's Pipit		*
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella		*
Oriolidae	<i>Oriolus sagittatus</i>	Olive-backed Oriole	*	*
Oriolidae	<i>Sphecotheres viridis</i>	Figbird		*
Otididae	<i>Ardeotis australis</i>	Australian Bustard	*	*
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike-Thrush	*	*
Pachycephalidae	<i>Colluricincla megarrhyncha</i>	Little Shrike-Thrush		*
Pachycephalidae	<i>Oreica gutturalis</i>	Crested Bellbird		*
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler	*	*
Pardalotidae	<i>Acanthiza apicalis</i>	Inland Thornbill		*
Pardalotidae	<i>Acanthiza chrysorrhoa</i>	Yellow-Rumped Thornbill		*
Pardalotidae	<i>Acanthiza nana</i>	Yellow Thornbill		*
Pardalotidae	<i>Acanthiza reguloides</i>	Buff-rumped Thornbill	*	*
Pardalotidae	<i>Gerygone fusca</i>	Western Gerygone		*
Pardalotidae	<i>Gerygone olivacea</i>	White-throated Gerygone		*
Pardalotidae	<i>Pardalotus rubricatus</i>	Red-browed Pardalote		*
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote	*	*
Pardalotidae	<i>Smicromnis brevirostris</i>	Weebill	*	*

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Family	Species	Common name	CURR	QPWS
Passeridae	<i>Poephila cincta</i>	Black-throated Finch		*
Passeridae	<i>Taeniopygia bichenovii</i>	Double-barred Finch	*	*
Passeridae	<i>Taeniopygia guttata</i>	Zebra Finch		*
Pelicanidae	<i>Pelecanus conspicillatus</i>	Australian Pelican		*
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin		*
Petroicidae	<i>Melanodryas cucullata</i>	Hooded Robin		*
Petroicidae	<i>Microeca fascians</i>	Jacky Winter	*	*
Petroicidae	<i>Petroica goodenovii</i>	Red-capped Robin		*
Phalacrocoracidae	<i>Phalacrocorax carbo</i>	Great Cormorant		*
Phalacrocoracidae	<i>Phalacrocorax melanoleucos</i>	Little Pied Cormorant		*
Phalacrocoracidae	<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant		*
Phasianidae	<i>Coturnix pectoralis</i>	Stubble Quail		*
Phasianidae	<i>Coturnix ypsilophora</i>	Brown Quail		*
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth	*	*
Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe		*
Pomatostomidae	<i>Pomatostomus temporalis</i>	Grey-crowned Babbler		*
Psittacidae	<i>Aprosmictus erythropterus</i>	Red-winged Parrot	*	*
Psittacidae	<i>Melopsittacus undulatus</i>	Budgerigar		*
Psittacidae	<i>Platycercus adscitus</i>	Pale-headed Rosella	*	*
Psittacidae	<i>Psitteuteles versicolor</i>	Varied Lorikeet		*
Psittacidae	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet		*
Ptilonorhynchidae	<i>Chlamydera maculata</i>	Spotted Bowerbird		*
Ptilonorhynchidae	<i>Chlamydera nuchalis</i>	Great Bowerbird		*
Rallidae	<i>Fulica atra</i>	Eurasian Coot		*
Rallidae	<i>Gallinula tenebrosa</i>	Dusky Moorhen		*
Rallidae	<i>Gallinula ventralis</i>	Black-tailed Native-hen		*
Rallidae	<i>Porphyrio porphyrio</i>	Purple Swamphen		*
Recurvirostridae	<i>Himantopus himantopus</i>	Black-winged Stilt		*
Scolopacidae	<i>Tringa stagnatilis</i>	Marsh Sandpiper		*
Strigidae	<i>Ninox connivens</i>	Barking Owl		*
Strigidae	<i>Ninox novaeseelandiae</i>	Southern Boobook	*	*
Sylviidae	<i>Cincloramphus cruralis</i>	Brown Songlark		*
Sylviidae	<i>Cincloramphus mathewsi</i>	Rufous Songlark		*
Threskiornithidae	<i>Platalea regia</i>	Royal Spoonbill		*
Threskiornithidae	<i>Threskiornis molucca</i>	Australian White Ibis		*
Threskiornithidae	<i>Threskiornis spinicollis</i>	Straw-necked Ibis		*
Turnicidae	<i>Turnix maculosa</i>	Red-backed Button-Quail		*
Turnicidae	<i>Turnix pyrrhothorax</i>	Red-chested Button-Quail		*
Turnicidae	<i>Turnix varia</i>	Painted Button-Quail		*
Turnicidae	<i>Turnix velox</i>	Little Button-Quail		*
Tytonidae	<i>Tyto alba</i>	Barn Owl		*
Tytonidae	<i>Tyto novaehollandiae</i>	Masked Owl	*	
Amphibians				
Bufo	<i>Bufo marinus</i>	Cane Toad	*	*
Hylidae	<i>Cyclorana novaehollandiae</i>	New Holland Frog	*	*
Hylidae	<i>Litoria alboguttata</i>	Striped Burrowing-frog		*
Hylidae	<i>Litoria caerulea</i>	Green Tree Frog	*	*
Hylidae	<i>Litoria inermis</i>	Bumpy Rocketfrog		*
Hylidae	<i>Litoria latopalmata</i>	Broad-palmed Rocketfrog	*	*

Family	Species	Common name	CURR	QPWS
Hylidae	<i>Litoria rubella</i>	Naked Treefrog		*
Myobatrachidae	<i>Limnodynastes ornatus</i>	Ornate Burrowing-Frog	*	*
Myobatrachidae	<i>Limnodynastes terrareginae</i>	Northern Pobblebonk Frog		*
Myobatrachidae	<i>Pseudophryne major</i>	Majors toadlet	*	
Myobatrachidae	<i>Uperoleia littlejohni</i>	Littlejohns Gungan		*
Myobatrachidae	<i>Uperoleia lithomoda</i>	Stonemason Gungan	*	
mammals				
Canidae	<i>Canis lupus dingo</i>	Dingo		*
Dasyuridae	<i>Planigale maculata</i>	Common Planigale	*	
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail bat	*	
Emballonuridae	<i>Taphozous georgianus/troughtoni</i>	Common/Troughton's Sheath-tail bat	*	
Macropodidae	<i>Lagorchestes conspicillatus</i>	Spectacled Hare-wallaby		*
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo	*	*
Macropodidae	<i>Macropus robustus</i>	Walleraroo	*	*
Macropodidae	<i>Macropus rufus</i>	Red Kangaroo	*	
Macropodidae	<i>Petrogale assimilis</i>	Allied Rock-wallaby		*
Macropodidae	<i>Wallabia bicolor</i>	Swamp Wallaby	*	*
Molossidae	<i>Chaerephon jobensis</i>	Northern Freetail-bat	*	
Molossidae	<i>Mormopterus beccarii</i>	Beccari's Freetail bat	*	*
Muridae	<i>Pseudomys delicatulus</i>	Delicate Mouse	*	
Muridae	<i>Pseudomys desertor</i>	Desert Mouse	*	
Muridae	<i>Pseudomys patrius</i>	Pebble-mound Mouse	*	
Muridae	<i>Rattus sordidus</i>	Canefield Rat	*	
Muridae	<i>Zyomys argurus</i>	Common Rock Rat	*	
Petauridae	<i>Petaurus breviceps</i>	Sugar Glider	*	
Phalangeridae	<i>Trichosurus vulpecula</i>	Common Brushtail Possum		*
Phascolarctidae	<i>Phascolarctos cinereus</i>	Koala	*	
Rhinolophidae	<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe-bat	*	
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	*	*
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled bat	*	
Vespertilionidae	<i>Miniopterus australis</i>	Little Bent-wing Bat	*	
Vespertilionidae	<i>Miniopterus schreibersii</i>	Common Bent-wing Bat	*	
Vespertilionidae	<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat	*	
Vespertilionidae	<i>Scotorepens greyii</i>	Inland Broad-nosed bat	*	
Vespertilionidae	<i>Vespadelus troughtoni</i>	Eastern Cave Bat	*	
Reptiles				
Agamidae	<i>Chlamydosaurus kingii</i>	Frill-necked lizard	*	*
Agamidae	<i>Diporiphora australis</i>	Eastern Two-line Dragon	*	*
Agamidae	<i>Pogona barbata</i>	Bearded Dragon		*
Chelidae	<i>Elseya dentata</i>	Northern Snapping Turtle		*
Chelidae	<i>Elseya latisternum</i>	Eastern Snapping Turtle	*	
Colubridae	<i>Dendrelaphis punctulata</i>	Common Tree Snake	*	*
Elapidae	<i>Acanthophis antarcticus</i>	Common Death Adder	*	*
Elapidae	<i>Furina ornata</i>	Orange-naped Snake	*	*
Elapidae	<i>Pseudonaja textilis</i>	Eastern Brown Snake	*	*
Elapidae	<i>Simoselaps australis</i>	Coral Snake		*
Gekkonidae	<i>Diplodactylus conspicillatus</i>	Fat-tailed Diplodactylus	*	
Gekkonidae	<i>Diplodactylus steindachneri</i>	Box-patterned gecko	*	*
Gekkonidae	<i>Diplodactylus vittatus</i>	Wood Gecko	*	

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Family	Species	Common name	CURR	QPWS
Gekkonidae	<i>Diplodactylus williamsi</i>	gecko	*	
Gekkonidae	<i>Gehyra dubia</i>	House Gecko	*	*
Gekkonidae	<i>Gehyra variegata</i>	Variegated Gecko	*	*
Gekkonidae	<i>Heteronotia binoei</i>	Bynoe's Gecko	*	
Gekkonidae	<i>Nephurus asper</i>	Rough Knob-tail	*	
Gekkonidae	<i>Oedura castelnaui</i>	Northern Velvet Gecko	*	
Gekkonidae	<i>Oedura monilis</i>	Ocellated Velvet Gecko	*	
Gekkonidae	<i>Oedura rhombifer</i>	Zigzag Velvet Gecko	*	
Pygopodidae	<i>Lialis burtonis</i>	Burton's Legless Lizard	*	
Pygopodidae	<i>Pygopus schraderi</i>	Hooded Scaly Foot	*	
Scincidae	<i>Anomalopus gowi</i>	Speckled Worm-skink	*	
Scincidae	<i>Carlia jarnoldae</i>	Lined Rainbow-skink		*
Scincidae	<i>Carlia munda</i>	Shaded-litter Rainbow-skink	*	
Scincidae	<i>Carlia schmeltzii</i>	Robust Rainbow-skink	*	*
Scincidae	<i>Cryptoblepharus carnabyi</i>	Spiny-palmed Shinning-skink	*	*
Scincidae	<i>Cryptoblepharus plagioccephalus</i>	Callose-palmed Shinning-skink		*
Scincidae	<i>Ctenotus pantherinus</i>	Leopard Ctenotus	*	
Scincidae	<i>Ctenotus spaldingi</i>	Straight-browed Ctenotus	*	*
Scincidae	<i>Ctenotus rosarius</i>	Desert Upland Ctenotus	*	
Scincidae	<i>Egernia striolata</i>	Tree Skink		*
Scincidae	<i>Eulamprus sokosoma</i>	Barred-sided Skink	*	
Scincidae	<i>Glaphyromorphus punctulatus</i>	Fine-spotted Mulch-skink	*	
Scincidae	<i>Lerista muelleri</i>	Wood Mulch-slider	*	
Scincidae	<i>Lerista wilkinsi</i>	Two-toed Fine-lined Slider	*	
Scincidae	<i>Lygisaurus foliorum</i>	Tree-base Litter-skink	*	
Scincidae	<i>Menetia greyii</i>	Common Dwarf Skink	*	
Scincidae	<i>Menetia timlowi</i>	skink	*	
Scincidae	<i>Morethia taeniopleura</i>	Fire-tailed Skink	*	
Scincidae	<i>Proablepharus tenuis</i>	Northern Soil-crevice Skink	*	
Scincidae	<i>Tiliqua scincoides</i>	Eastern Blue-tongue Lizard		*
Varanidae	<i>Varanus gouldii</i>	Gould's/Sand Monitor		*
Varanidae	<i>Varanus tristis</i>	Black-tailed Monitor	*	

APPENDIX 2



Eastern Spiny-tailed gecko *Strophurus williamsi*, a small but spectacular gecko recorded at its north-eastern distribution, at White Mountains.

Photo: A. Kutt



The Desert Mouse *Pseudomys desertor*, a species more common in Spinifex dune fields of central Australia was trapped in the deep red sandy *Eucalyptus* woodland on the upper sandstone surfaces of White Mountains.

Photo: A. Kutt



The Eastern Stone gecko *Diplodactylus vittatus*, a species that can tolerate cooler climates and ideally camouflaged to blend into its preferred habitat of well-timbered and stony *Acacia* woodlands. Another reptile species at its north-eastern distributional limit at White Mountains.

Photo: A. Kutt



The Box-patterned Gecko *Diplodactylus steindachneri*, a common semi-arid species in Queensland that inhabits insect or spider holes in sandy vegetation.

Photo: A. Kutt

APPENDIX 2



Narrow, confined crevices running at the end of the gorges at White Mountains National Park provided perfect locations to set harp-traps to target cavernicolous microchiropteran bats.

Photo: A. Kutt



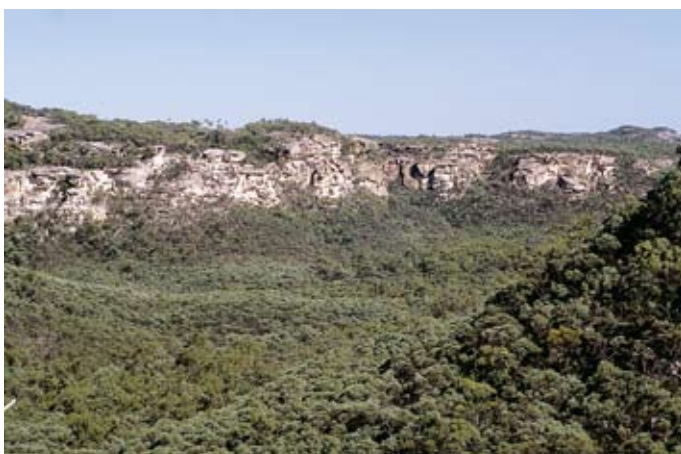
The Eastern Cave Bat *Vespadelus troughtoni*, one of the most common cave-dwelling bats recorded at White Mountains National Park.

Photo: A. Kutt



Jeanette Kemp, Queensland Herbarium demonstrating that a fundamental part of any fauna survey is the detailed descriptions of trapping sites. Without this information, most data on fauna distribution and abundance is meaningless.

Photo: A. Kutt



A common White Mountains vista: and also the habitat for the Common Rock Rat *Zyzomys argurus*.

Photo: A. Kutt

APPENDIX 2



Yvette Williams, School of Tropical Biology, James Cook University, proving that even pregnant women find the construction of pit fall traps dead easy.

Photo: A. Kutt



Within the tall wet gorges of the White Mountains there was ample evidence of Koalas *Phascolarctos cinereus*, a species that is generally restricted in semi-arid areas to mesic riparian areas.

Photo: A. Kutt

APPENDIX 2



After checking a line of Elliott traps up a steep cliff face, there's nothing more to do except collapse and admire the view.

Photo: A. Kutt